Emission Modes

Prepared by:

WD8PUO

The Holland Amateur Radio Club

A Course for Technicians & General Class

Emission Mode	Specifications	Required Tech Frequencies	Gen. Freq.
 CW (Data)	CW stands for "Continuous Wave". A continuous sine wave carrier is switched on and off. This is the simplest format. CW uses only 500HZ bandwidth. Carrier	3675 –3725KHz, 200 watts PEP 7100-7150KHz, 200 watts PEP 21.1 – 21.2MHz, 200 watts PEP 28.1-28.3MHz, 200 watts PEP 144-144.1MHz, 1500 watts PEP *Note: a Tech.+ requires a Certifi- cate of Successful Completion of Exam (CSCE). And, regardless of license, these HF frequencies are limited to 200W.	1.8-2.0MHz 1500W PEP 3.525-3.725KHz 1500W 7.025-7.150KHz 1500W 10.1-10.150MHz 200W 14.025-14.150MHz 1500W 18.068-18.110MHz 1500W 21.025-21.2MHz 1500W 24.890-24.930MHz 1500W 28-28.3MHz 1500W
 AM Phone	AM - "Amplitude Modulation". The voice varies the height of the sine wave peaks. Also called Double Side-band. Utilizes a carrier. AM is a wide signal requiring 5KHz of bandwidth. Lower Side Band / Upper side Band	AM is seldom used in the VHF and UHF bands because of the extreme high noise levels. A Technician+ may use Phone privileges, including AM on 28.3-28.6MHZ only. 200W PEP.	1.8-2.0MHz 1500W PEP 3.85-4.0MHz 1500W PEP 7.225-7.3MHz 1500W PEP 14.225-14.350MHz 1500W 18.110-18.168MHz 1500W 21.3-21.450MHz 1500W 24.930-24.990MHz 1500W 28.3-29.6MHz 1500W
 SSB Phone	SSB stands for "Single Side Band". SSB suppresses either the upper (LSB) or lower (USB) sideband and the car-rier. An artificial carrier is introduced at the receiver (beat frequency oscil-lator) converting the voice. 2KHz bandwidth. Lower Side Band / Upper side Band / Carrier suppressed 40db	The signal is very narrow using only about 2 KHz of band-width. SSB is limited to 28.3-28.5MHz on the 10 meter band, using 200 watts PEP. USB is used at 14MHZ and above, LSB is used below 14MHZ. *All power used on one side band!	1.8-2.0MHZ 1500W PEP 3.85-4.0MHz 1500W PEP 7.225-7.3MHz 1500W PEP 14.225-14.350MHz 1500W 18.110-18.168MHz 1500W 21.3-21.450MHz 1500W 24.930-24.990MHz 1500W 28.3-29.6MHz 1500W
 FM Phone	FM stands for "Frequency Modula-tion". FM varies the distance between the sine wave carrier peaks, while the height of the peaks remains constant. FM is very wide bandwidth and cannot be used below 29.5MHz. 5KHz deviation standard above 29 MHz.	Used almost exclusively as the standard phone format above 50MHz. NOTE: PM-Phase modulation is similar to FM, but shifts the phase of the sine-wave. It	Used almost exclusively as the standard phone format above 50MHz.

Emission Modes: *Bandwidth Formulas*

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FM- Frequency Modulated Bandwidth:

[Deviation (5KHz) + Modulation (3KHz)] x 2 = 16KHz

Illustration: The total bandwidth of an FM phone transmission having a 5KHz deviation and a 3KHz modulating frequency would be 16KHz.

PM – Phase Modulated Bandwidth:

Determine the Frequency Multiplication Factor by dividing the oscillator frequency (12.21MHz) into the output frequency (146.52). This gives us a multiplication factor of 12. If the transmitter deviation is 5KHz (5000Hz), ½ deviation at the oscillator input is 12 divided into 5000Hz, with an answer of 416.7Hz.

Frequency Multiplication Factor: 146.52 / 12.21 = 12

½ Deviation: 5000Hz / 12 = 416.7Hz

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Repeaters do exactly what the name implies... they repeat your signal!

- Common in the VHF spectrum where "Line-Of-Site" propagation requires signals to be boosted in order to obtain greater coverage.
- Repeaters receive on one frequency and transmit on another, this is called "Split-Mode" (typically 600 KHz on 2-meters, 1.6MHz on 1.25-meters, & 5MHz on 70cm band) verses "Simplex" which uses a single frequency for transmit and receive. Use simplex when possible.
- Repeaters often incorporate a PLL Tone Burst requirement to allow signals utilizing the tone-burst to be received, and those that do not use the tone-burst to be rejected. A Courtesy Tone is a tone at the end of a transmission letting the receiving person know the transmission has ended.
- Repeaters are often equipped with an Autopatch, allowing for the use of the telephone service. Autopatch communication is Third-Party-Traffic. The FCC discourages third-party-traffic during rush-hour.
- Repeaters often have a Time-Out-Timer, limiting the transmission time (3 minutes in Holland).
- Pause between transmissions to wait for

Emission Modes: *Repeaters*

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- If two repeaters conflict with one another, and the FCC rules one has priority, it is the responsibility of the secondary repeater system to correct the problem.
- If two repeaters conflict with one another, and the FCC rules both have priority, it is the responsibility of both repeaters to correct the problem.
- Break into a repeater conversation by giving your call-sign.
- FM- Frequency modulated phone is most common on r
- …aters!

What is a LEO Satellite?

Low Earth Orbit

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- Repeaters and the Internet (Explain & Demonstrate)
  - IRLP –
  - Echolink –
  - APRS –
  - GPS -

Digital Emission Modes: *RTTY*

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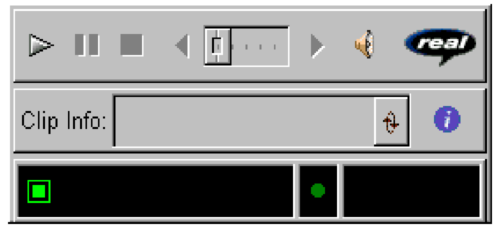
RTTY, 45 Baud

This is a recording I made off the air of RTTY at 45.4545.. Baud or 60 WPM. The sender seems to be typing at about 40 WPM and the TNC pauses and gives the "Wait" or "Diddle" tones frequently. The diddle tone sounds much better than a continuous tone and also lets the receiving TNC maintain synchronization.
The tones are "High" , 2125 Mark and 2295 Space in Hertz. In Europe, low tones near 1300 Hz are popular.

A Terminal Node Controller



A RTTY Tutorial

RTTY or RadioTeletype is a direct machine to machine communications mode using the Baudot (or Murray) code.

This mode became popular with many amateurs when surplus TTY machines became available at a reasonable cost after World War II. These mechanical monsters provided a keyboard for Input and a paper roll for printed Output. They were also useful to help hold the house down in times of hurricane winds - they must weigh a ton. Video displays were still too exotic and expensive in those days. It was not until the mid 1970s that we began to see the Video Display come into more widespread use. (By the way, have you ever wondered why early Program Languages like BASIC use the command PRINT to display their output?)

When transmitting Morse Code, the transmitter is switched on and off to make the dits and dahs. When sending Teletype however the transmitter runs continuously, sending either of two frequencies conventionally known as Mark and Space (a reference to paper tape reception of telegraphy). The early pioneers found on-off keying was not all that successful for Teletype signals because of interference from static.

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Digital Emission Modes: *RTTY*

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They experimented with FSK, or Frequency Shift Keying and found it performed much better. With FSK, the transmitter is shifted up in frequency every time a Mark is to be sent, reverting to the lower frequency for a Space. The amount of the shift is usually 170 Hz for Amateur Radio use although many commercial Teletype signals use other shifts, notably 425 Hz and 850 Hz.

Many systems use AFSK or Audio Frequency Shift Keying. When this is sent, the transmitting station generates the Mark and Space audio tones and feeds them into the transmitter's microphone input. The result at the receiving end is that the same audio tones are heard and processed, whether the transmitting station used FSK or AFSK.

When listening to a teletype signal off air, you will soon get to recognise the familiar warble of Mark and Space tones.

In the amateur shack the TTY machine is usually connected to an HF receiver or transceiver which the operator tunes so that the received audio is just the right pitch or audio frequency to trigger the demodulator's Mark and Space resonators.

If the receiver is slightly off the correct frequency the tones vary and the text becomes garbled or even lost altogether. To help the other station tune the receiver correctly, a RTTY operator can send a string of alternate R and Y characters RYRYRYRYRY. This pattern is chosen as it produces the most frequent and almost symmetrical alternation of Mark and Space tones, giving the receiving operator the best chance to tune the receiver before the "real" message starts. However, even if the signal is accurately tuned, the information can become garbled or completely lost due to interference, fading, or noise. Often, it is possible to make sense of the message even with parts missing, but RTTY is by NO means an error free mode!

The Baudot code is a 5 bit code and those of you who are familiar with Binary Notation will know that the maximum number of values we can have with 5 bits is 32. That means that each unit of transmission, one keystroke if you like, can contain any one of 32 possible values. If you look up a table of Baudot codes you will see there are 32 values listed, one code for each letter of the alphabet plus a few other codes for other things such as a space and a Carriage Return. But, what if we want to send a number such as "9" or a question mark? These are not mentioned in that table because all 32 codes are already used.

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The solution is rather similar to the Typewriter or Computer Keyboard where we have the Shift key to get various additional codes from the keyboard. Most keys will produce a different result if we hold down the Shift key as we type. Well, one of those original 32 codes is a special code known as FIGS (for Figures Shift). The convention is that when we want to send a number or some other special character such as a punctuation mark, we can do that by firstly transmitting a FIGS code.

Then instead of using that original table of 32 codes, we have a second table of codes to use, and that second table includes all ten numeric digits and various punctuation marks. Provided both sides of the conversation observe the convention, the sender can send a FIGS and start using the second table; the receiver will see the FIGS code and it too will interpret all data that follows from the second table.

With just 5 bits of data we then have almost 64 different codes we can send and receive. (I say almost because there is some duplication in the two tables, including a space and a Carriage Return but that is not important here). Even that many codes is not enough to handle all 26 letters of the alphabet in both UPPER and lower case, so RTTY systems always operate in upper case only.

If we wanted to type a big number (say "13579") we don't have to send FIGS before every digit. We send that code only once and the receiver then will take EVERYTHING we type from now as if it belongs in the second table. When we want to revert to the normal alphabetic table of codes we can send another special code, this one called LTRS (for Letters Shift). Then everything goes back to normal, using the original alphabetic table of codes.

Normally we don't have to concern ourselves with these FIGS and LTRS codes. Our computing equipment will take care of those things for us. We just type away and rely on the system to generate and send those codes when necessary.

As I mentioned earlier, it is quite possible to lose bits here and there when receiving a RTTY signal, whether it be because of fading, interference, frequency drift, or whatever. One of the big problems with lost data is the possible loss of a FIGS or LTRS code! Say we had sent "13579" and then typed "HAPPY BIRTHDAY". Our equipment would have sent a LTRS code before the first "H" but what if the receiver did not copy the LTRS code we sent? Can you imagine what happens? As far as the receiver is concerned we are still sending numbers or other codes from the numeric table! So our "HAPPY BIRTHDAY" is going to come out looking something like "#-006 ?845#$-6". And ...

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EVERYTHING we type from then on is going to look just as strange until we happen to send another LTRS code later. It is for this reason that many systems include an option to "Un-shift on space". If you have a multi mode TNC capable of handling RTTY, you will probably have this option in your TNC. If that option is ON then your receiving system will imply a LTRS code every time it receives a space. So if you seem to be copying lots of funny numbers from a strong, well tuned signal, try setting that option ON.

We can overcome some of these problems by using ASCII instead of using the Baudot code. With ASCII (7-bit) we can have 128 different codes so we do not need the FIGS/LTRS codes. All Personal Computers use ASCII as their native "language" so it would be a reasonable thing to use. Although not part of the defined ASCII standard, it has become an almost de-facto standard in the computer world that an additional 128 characters are available, often called Extended ASCII. But, despite these benefits, Baudot continues to rule the airwaves for Amateur and Commercial Teletype transmissions.

Today, RTTY is still a popular mode especially on the HF bands, and the advent of the "Glass Terminal", firstly the Dumb Terminal and now the Personal Computer, has brought this mode to even more operators the world over. Many specialised RTTY systems were developed for the Amateur enthusiasts but have been superseded now by the Personal Computer with one of the Multi Mode TNCs which handle RTTY and many other modes besides.

The latest Computerised RTTY equipment generally allows us to use the mode better, quieter, more efficiently, using less power and occupying less space than the old TTY machines, but the limitations of the mode remain.

- RTTY is “Direct-Printing Telegraphy emissions.
- The maximum symbol rate permitted for RTTY or data transmissions on 6 and 2 meters is19.6 kilobauds, on 10 meters it’s 1200 bauds, below 28MHZ it is 300 bauds.
- RTTY means “Radioteletype”.
- Responding to a RTTY “CQ”, one should use the same speed.
- RTTY requires a modem and a teleprinter or computer system.
- RTTY signals use “Frequency Shift Keying” (FSK). Greater keying speeds= greater freq. shifts

Digital Emission Modes: *Packet*

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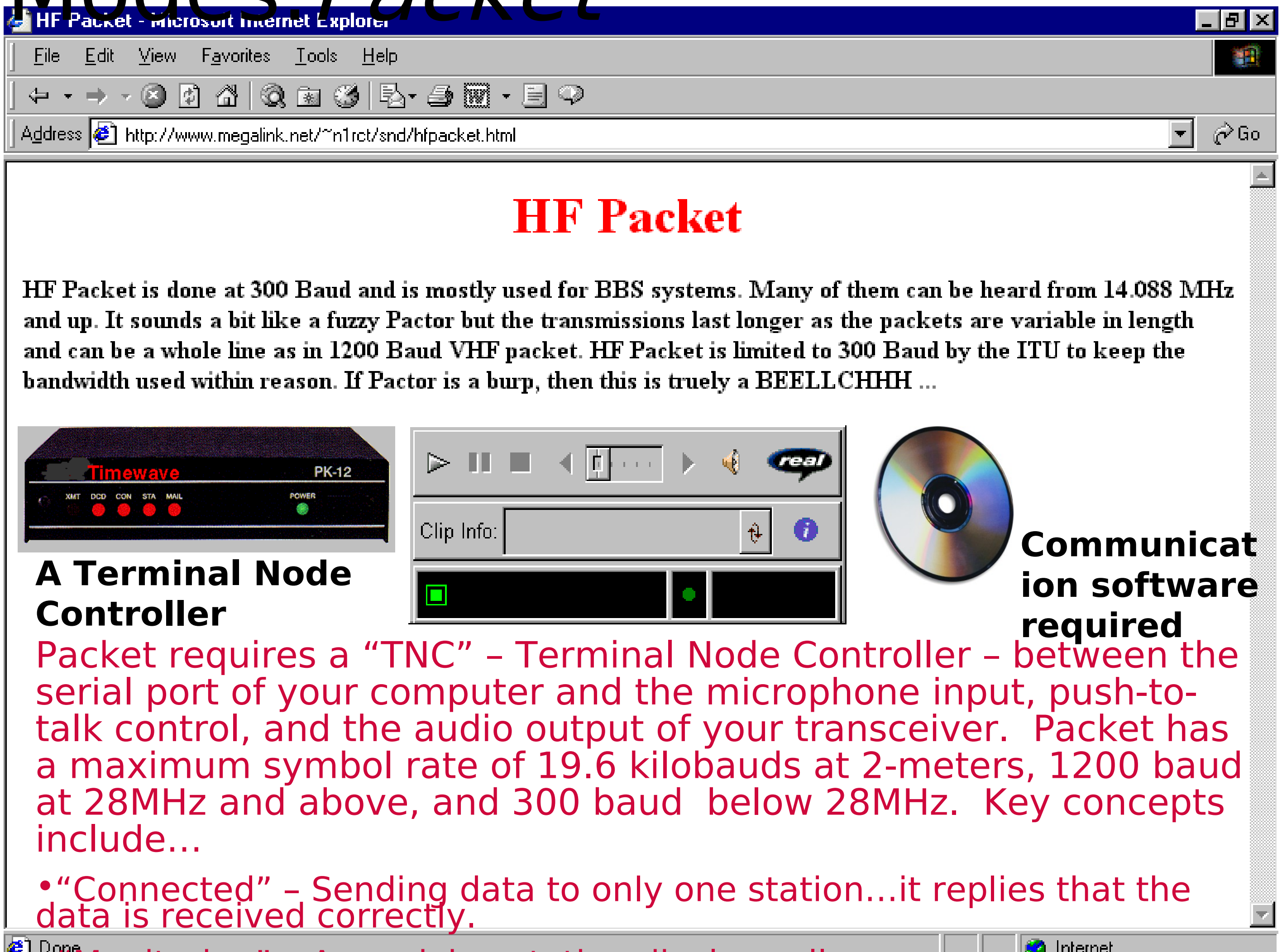

A Terminal Node Controller

Communication software required

Packet requires a "TNC" – Terminal Node Controller – between the serial port of your computer and the microphone input, push-to-talk control, and the audio output of your transceiver. Packet has a maximum symbol rate of 19.6 kilobauds at 2-meters, 1200 baud at 28MHz and above, and 300 baud below 28MHz. Key concepts include…

- "Connected" – Sending data to only one station…it replies that the data is received correctly.
- "Monitoring" – A receiving station displays all messages on a frequency, but does not reply.
- "Digipeater" – A packet-radio station that retransmits only data marked to be retransmitted.

30 Min. Lecture on Packet: http://www.tapr.org/tapr/ra/dayton.94.jones.28.ram

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Packet Tutorial:

HF Packet uses the standard AX.25 protocol same as for VHF Packet. It is run at a fixed 300 baud rate for HF. Data is arranged in packets of up to 256 bytes of 8 bit ASCII data. Each packet contains a 1 byte start flag, 3 byte address field, 1 byte control field, 0-256 bytes of data, 2 byte CRC and finally a 1 byte end flag. Packets are transmitted with no fixed timing. See the latest specification published by the American Radio Relay League (ARRL) for complete details on this system. There is also some 1200 baud PSK work done in the 10 meter ham band.

Automatic Packet Reporting System or APRS, is an application that runs "on top of" AX.25. It was invented by Bob Bruninga WA4APR (clever call letters) that utilizes GPS data to plot a packet station's location on a map of a given region, city, state, or even country. Due to the graphics involved, some units may not read this data; however, units like the PK232 can read it with the use of special software. Signals utilizing this mode are found in the 40 and 30 meter bands (for example) utilizing 'gateways' into 2 meters.

Packet radio has been around since the mid-1960's, but was first seen on the amateur bands in 1978 through research done in Montreal, Canada in 1978, with the first transmission occurring on May 31st. This was followed by the Vancouver Amateur Digital Communication Group (VADCG) development of a Terminal Node Controller (TNC), also known as the VADCG board, in 1980. This was then followed by TAPR (Tucson Amateur Packet Radio) with the creation of the TNC-1 in 1982 and then the TNC-2 in '84-'85. Ten years ago, the packet radio revolution ignited when TAPR sold over a thousand TNC-2 kits. The TNC-2 was what was needed to make this mode, that a few experimenters were playing with, into something that every amateur could enjoy. From its humble beginnings, where it was good luck to have more than three packet operators in the same city, packet radio now has thousands of amateurs using it daily, various manufacturers making and selling TNCs (terminal Node Controllers), and over a hundred thousand TNCs having been sold to date. What growth! No other mode of amateur radio has seen such explosive growth!

Like the title says, 'Why Packet Radio ?' Like any mode in the amateur service, it provides a group of amateurs with a way of having fun and meeting one of our primary aims, 'improving the radio art.' Packet radio was a new mode in the early 80's that many of the outstanding amateur experimenters worked on and developed. The result, ten years later, is something that provides a lot of different operating opportunities. No longer is it just packet radio, but now it is bulletin board systems, DX Clusters, chat bridges, networking, emergency

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Packet Bulletin Board Systems (BBS):

Most cities have one or more packet Bulletin Board Systems, or BBS for short. BBSs do two main things: send and receive personal messages for their local users (like yourself) and send and receive messages or bulletins intended for people locally or around the world. Since the BBS is part of a national system of other BBSs, it has the ability to pass information or messages to any other BBS in the US or the world. This allows you to send messages to friends locally, to someone located in the next state, or to someone on the other side of the world. The second thing that BBSs do is pass local and national bulletins, which are messages intended to be read by everyone. In this way, amateurs can read the latest messages about the ARRL, AMSAT, TAPR, propagation, DX, and other bulletins on varied topics. Message passing is the primary purpose of a BBS system, but BBSs can also support callbook programs, help references, Internet access, and more. Operators of BBS systems are a good place to start when you first get on the air. Because of the service they provide, they have to know how packet is working in the local area.

Keyboard-to-Keyboard:

Like other amateur modes (SSB, FM, etc), packet radio can be used to talk to other amateurs directly. Amateurs can talk to each other simultaneously using their keyboards when they can directly communicate with each other. With the use of networks (see a little later), amateurs can talk at a distance beyond the reach of their own stations by using the network. Keyboard-to-keyboard communications is one of the least frequent methods of packet communications, because amateurs are rarely on packet at the same time. Many packet operators send electronic mail using either personal mailboxes or a local BBS. In this way, messages are read when the amateur is on the air. Another limitation of direct keyboard-to-keyboard packet is that you can only talk to one packet station at a time. One easy way to hold round table discussions like on a voice repeater. Some areas support chat or conference bridges, which allow for more than one amateur to talk to each other. Much like a voice repeater. If a chat is supported over a network, then you can talk as far away as the network reaches.

DX Packet Cluster:

Many cities have DX (foreign amateur) spotting nodes or networks. HF (High-frequency) operators connect to their local DX Packet Cluster in order to receive reports on the latest DX. This type of packet came about from those interested in chasing DX. Many amateurs like to frequent the HF bands looking for rare international operators to contact. A DX Cluster allows many HF operators [illegible] at the same time while

Ham Radio

Digital Emissions: *Packet*

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When someone finds a DX station, they send a packet message to the DX Cluster, which then sends the information to all other packet operators using the DX Cluster. In this way, you have several stations monitoring the band, looking for DX. Often an amateur will 'spot' (hear) a DX station and then distribute the DX report almost instantly. DX Clusters allow everyone to operate many more hard to find DX stations in one evening than was possible operating by oneself. Some amateurs have been known to attain enough contacts to qualify for DXCC in a matter of weeks. One point though, if your HF station is not a 'big-gun', then it is sometimes best to operate the DX station before posting your spot for others to find. There is a good chance that a pile-up will occur as soon as you make your spot to the DX Cluster and then you will not be able to work the DX station that you found!

RACES/ARES/NTS and Emergency Communications:

Packet radio is being used in many emergency services. Whether packet is used to pass a message accurately and in large quantities or to handle messages passed by the National Traffic System, it can provide an important function like any other amateur mode when used correctly. A new application called APRS combines GPS (Global Positioning Satellites) with packet radio to allow a master station to plot on their computer the location of all other stations in the field. The purpose is to coordinate the exact position of weather spotters or searchers, without having to waste radio time informing the control station of their locations. Recently, amateurs in Oklahoma have been distributing Doppler Radar images via the packet network. The small weather image file takes but a few minutes to retrieve and display. This helps those amateurs outside of the local ATV coverage to get an accurate weather picture from the Doppler Radar.

Networking:

Since amateurs use radios to transmit their data, their range of communications is limited to approximately line of sight. An average packet station talks in a radius of about 10-30 miles. Packet Networks allow amateurs to widen the area of communications past their line of sight, by having a series of packet stations linked by radio, that can be used to get their packet messages to where ever the network goes. Much like the telephone system, networks provide long distance service outside the local area. There are a number of amateur networks which allow amateurs to travel from one area to another. Network types include: NetRom, TCP/IP, TexNet, G8BPQ, ROSE, KaNodes, and many more.

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These networks are typically built by a local or regional group that allows packet operators to get outside of their area. Amateurs get hooked on building and maintaining such networks, just like some amateurs operate DX or handle emergency communications. The type of network you use locally will depend on your area. Much depends on the network philosophy the local group has chosen when developing their network.

Satellite Communications:

Many of the amateur radio satellites in orbit contain computer systems that provide packet capability. Most packet satellites provide BBS-like functions for messages to be passed to anywhere in the world within 24 hours. Several contain CCD cameras, which allow amateurs to download images of the earth and some allow users to retrieve data from the onboard experiments. Most satellites use AX.25 with special software developed for satellite communications. DOVE, Digital Orbit Voice Encoder, can be received with any normal VHF/FM 2-meter packet station, but most of the packet satellites use SSB and require more complex equipment in order to operate them. Just something else to spend your amateur dollars on.

Conclusion:

These are just some of the things you can do with packet radio. Once you find something that you can do with packet radio, then you have a reason to purchase the equipment necessary to get on the air. A good place to start is to find a friend who uses packet and go visit. See what your local area has to offer. As already stated, packet radio changes every 50-miles. What is being done where I operate is probably slightly different than what you can do where you live.

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AMTOR - BY TONY LONSDALE VK2DHU

AMTOR is a specialized form of RTTY. The term is an acronym for AMateur Teleprinting Over Radio and is derived from the commercial SITOR system (Simplex Telex Over radio) developed primarily for Maritime use in the 1970s.

In the early 1980's, Peter Martinez, G3PLX, made several minor changes to the SITOR protocol and called it AMTOR.

AMTOR improves on RTTY by incorporating a simple Error Detection technique. The system remains relatively uncomplicated but AMTOR performs well even in poor HF conditions. While there can still be many errors in AMTOR data, the Error Detection helps a lot and the result is quite tolerable for normal text mode conversations because of the high redundancy in plain language text. Certainly much better than RTTY. But for more critical data such as program code, or even some technical information messages, NO errors can be tolerated.

There are two modes used in Amtor: ARQ and FEC.

ARQ (A Mode)

This mode is a little different in that it is a Synchronous protocol, which means both stations are synchronised to each other's signals.

In ARQ mode (Automatic Repeat Query), sometimes called Mode A, data is sent in groups of 3 characters. Although each character is only 5 bits (same as for RTTY), two additional control bits make it up to 7 bits per "character" and they are set so there are always 4 marks and three spaces in every transmitted character. If the receiving station gets some other combination it knows an error has occurred. The 40 percent overhead is considered worthwhile to get some error detection. This technique can identify a lot of errors that might occur but is not as thorough as the methods used in PACTOR and Packet which we look at later.

The receiver responds to each 3 character group by sending either an ACK (ACKnowledge) code (if OK) or a NAK (Negative AcKnowledge). Each time the transmitting station gets a NAK, that 3 character group is sent again.

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Digital Emissions: AMTOR

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If you listen around on the HF bands in the recognised Data Segments of the bands, you might hear a chirp-chirp sound that identifies an ARQ transmission. Even when there is no data actually being transmitted, the transmitting station continues to send idle "chirps" to maintain the link.

Your AMTOR equipment probably supports a Listen Mode too and that allows you to monitor another ARQ session even though you are not participating in the session with the usual acknowledgements. Of course that means you don't get the opportunity to say "NAK" if you don't copy something properly!

FEC (B-Mode)

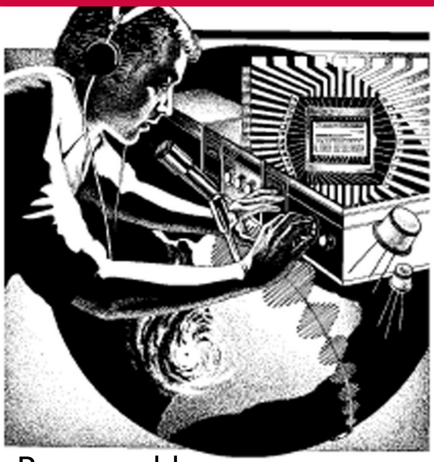
In FEC mode (Forward Error Correcting), sometimes called Mode B, the sending station sends each character twice so this mode provides a means of transmitting to several stations at once. The receiving station does not acknowledge the data received. If a receiving station matches both instances of a character, that character will be printed, otherwise some error symbol is printed. This mode does not provide for the receiver to ask for the missing data to be retransmitted. An FEC transmission sounds more like a Baudot RTTY signal.

The two stations need to keep in phase with each other so each FEC transmission is started with several sets of "phasing pairs" and these are sent at regular intervals even while there is no data being transmitted. Note: The duty cycle of a transmitter in mode-B is 100%.

FEC Mode is still better than ordinary RTTY but its error detection is not as reliable as that in the ARQ Mode.

AMTOR systems are still limited to the technology of the 60s with limitations such as the character set and the maximum transmission rate (100 baud) geared to the mechanical teleprinter. The Error Detection technique provides improved accuracy over the "vanilla" RTTY mode, but is still not entirely reliable. It is perhaps better termed Error Reduction than Error Detection and has limited application for critical data.

For more info. On digital communications, see: www.teleport.com/~nb6z/frame.ht



Prepared by:
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Get Started with HF SSTV at Little or No Expense

You don't have to spend lots of money to get started with SSTV. You can receive pictures with some free software and a trivial interface to get received audio into your computer.

This is what you will need:

- **Source of SSTV signals such as an HF SSB transceiver.**
- **IBM PC compatible computer with at least:**
  - **'386 or higher CPU**
  - **Color VGA display**
  - **Spare serial port (COM1 or COM2)**
  - **A mouse is handy but not essential**
- **A very simple interface to get audio into your computer. Use one of these if you already have one or build your own with a few parts from your local Radio Shack store.**
- **Learn More: http://www.ultimatecharger.com/SSTV.html**

Because of the wide bandwidth required for Fast Scan TV, the HF bands are restricted to using Slow Scan TV, which reproduces still imagery. Image emissions are typically found in the upper portion of the CW/data band sections.

Digital Emissions: Image

Prepared by:

WD8PUO

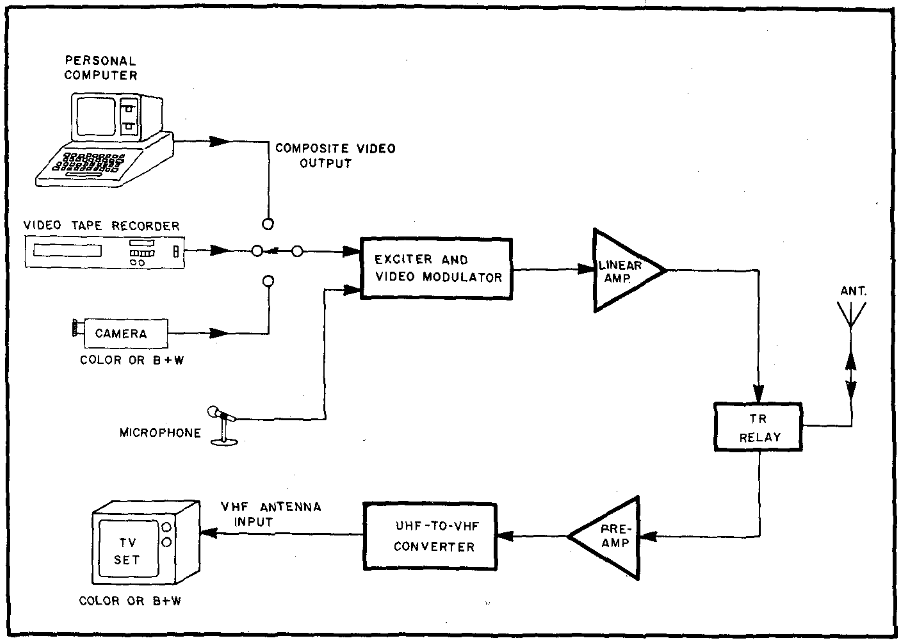

Fig. 7 — Fast-scan ATV station.

- Fast Scan TV (ATV) is used on the VHF band because it requires a great amount of bandwidth.
- Image emissions are permitted on the 2-meter band between 144.1 – 148 MHz.
- Image emissions are permitted on the 70 cm (440) band between 420-450 MHz. This is the most common band for FSTV because the cable channels 57-60 correspond to the 440 frequencies.

Ham Radio

Digital Emissions: *PSK31*

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What is PSK? Phase-Shift-Keying

Demonstrate PSK 31.

End of Lesson 3